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## (54) Knob position indicator

(57) Rotary movement of a control knob (5) operates a contact arrangement (10) which increments an electronic counter with a read out in an easily readable, stationary display field (9). The electronic display field (9) is mounted inside the rotary knob (5) at the front end face thereof. Thus there is provided a space-saving

arrangement of the display and the simultaneous observation of the rotary button and the display is rendered possible. The display field (9) is supported by a connection member (8) which projects above the rotary knob (5) towards the rear in the axial direction and the front end face of the rotary button is transparent essentially all around. Alternatively the knob may drive a coding switch.

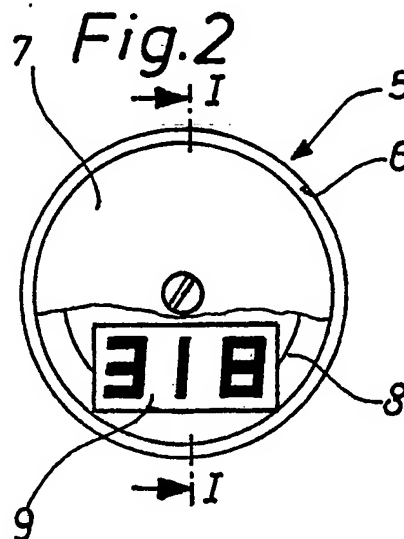
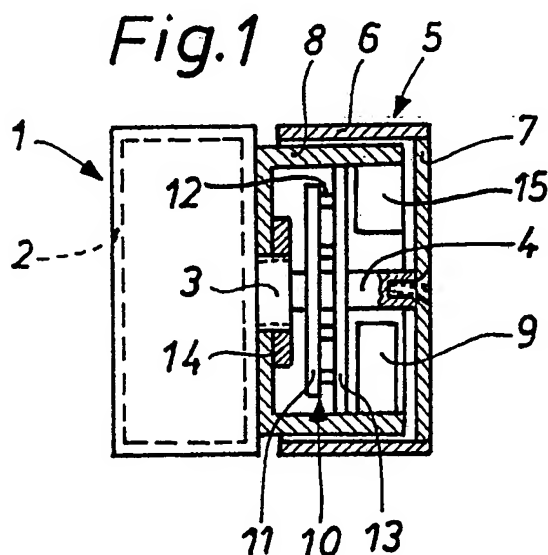


Fig.1

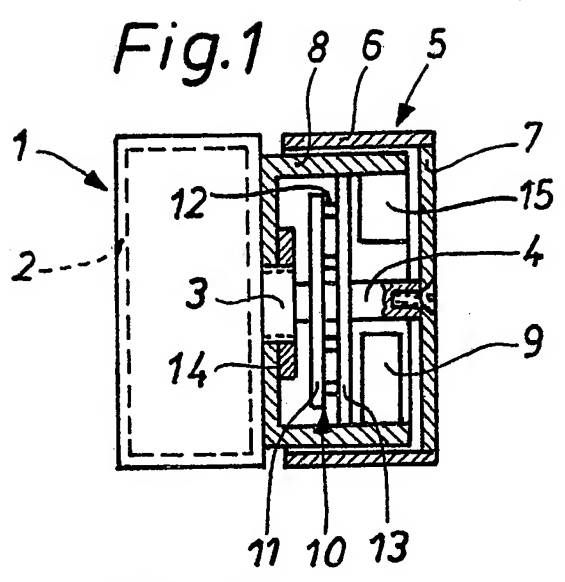


Fig.2

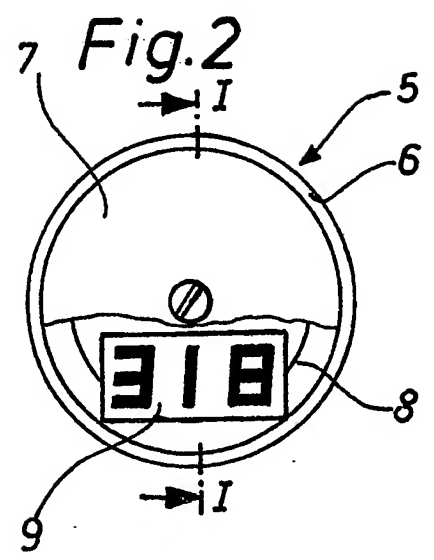


Fig.3

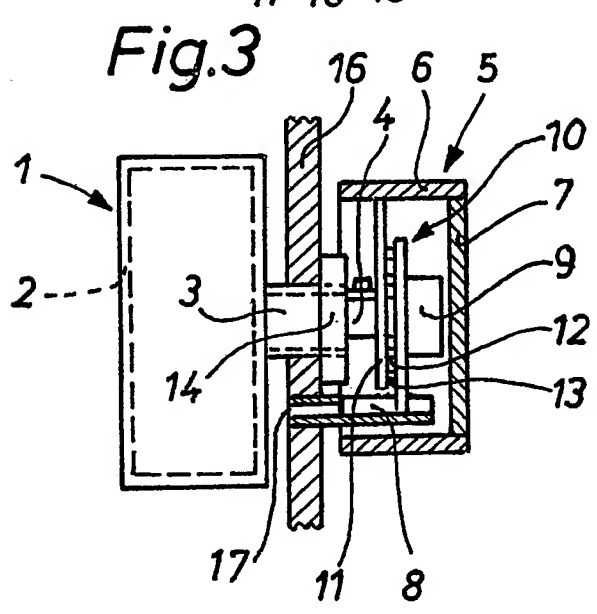


Fig.4

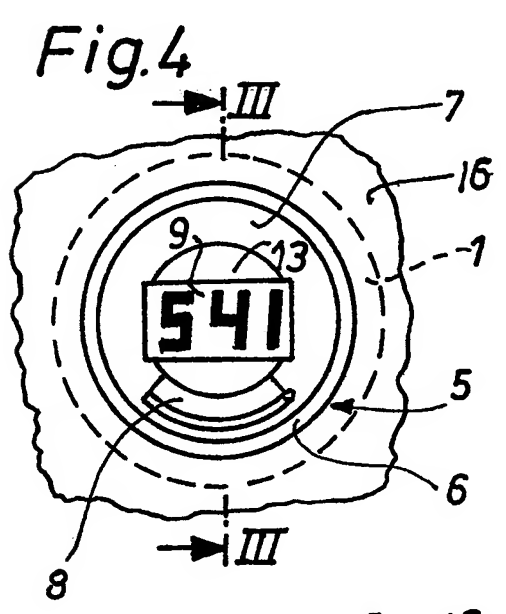


Fig.5

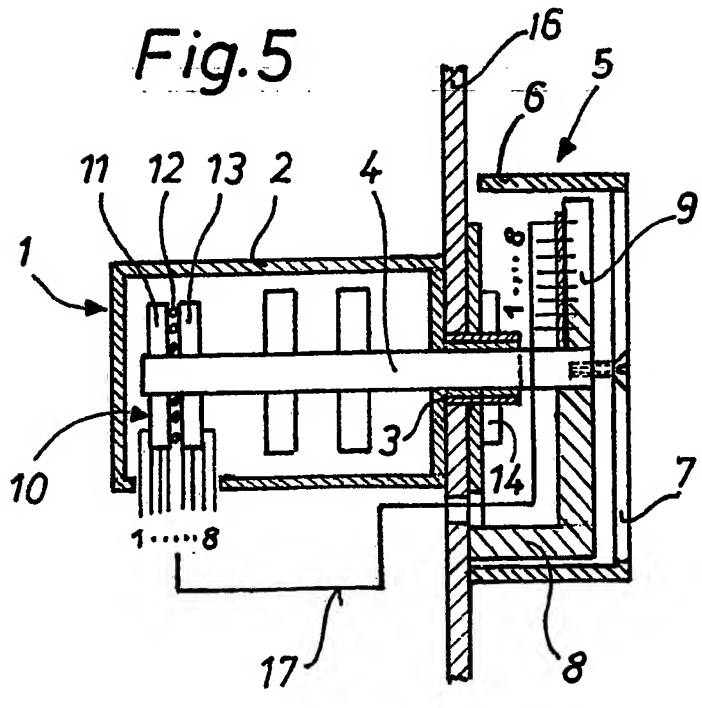
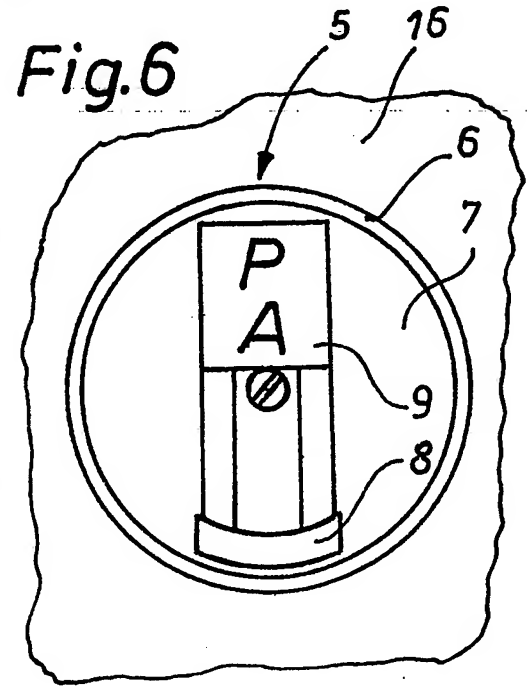
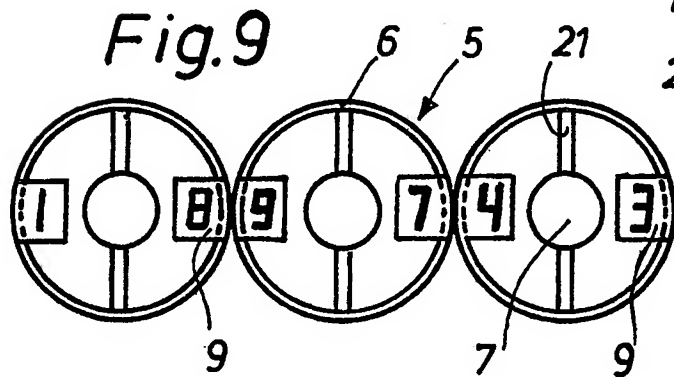
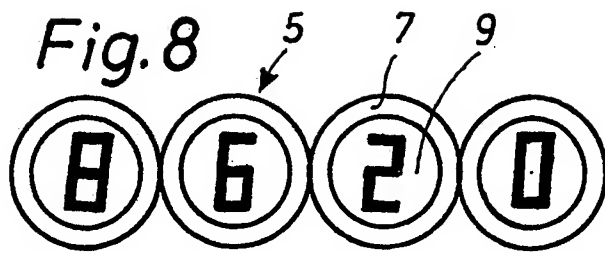
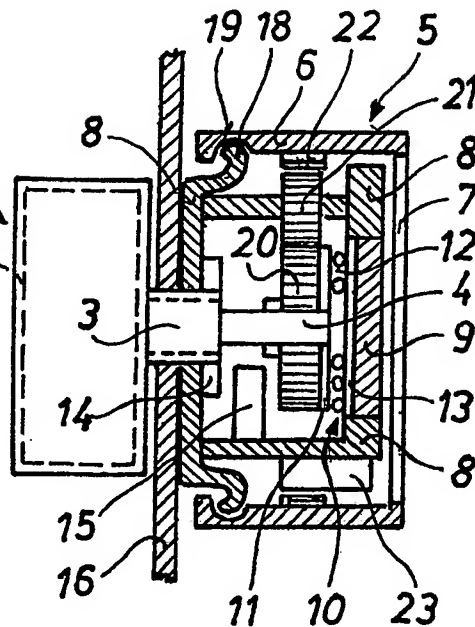


Fig.6

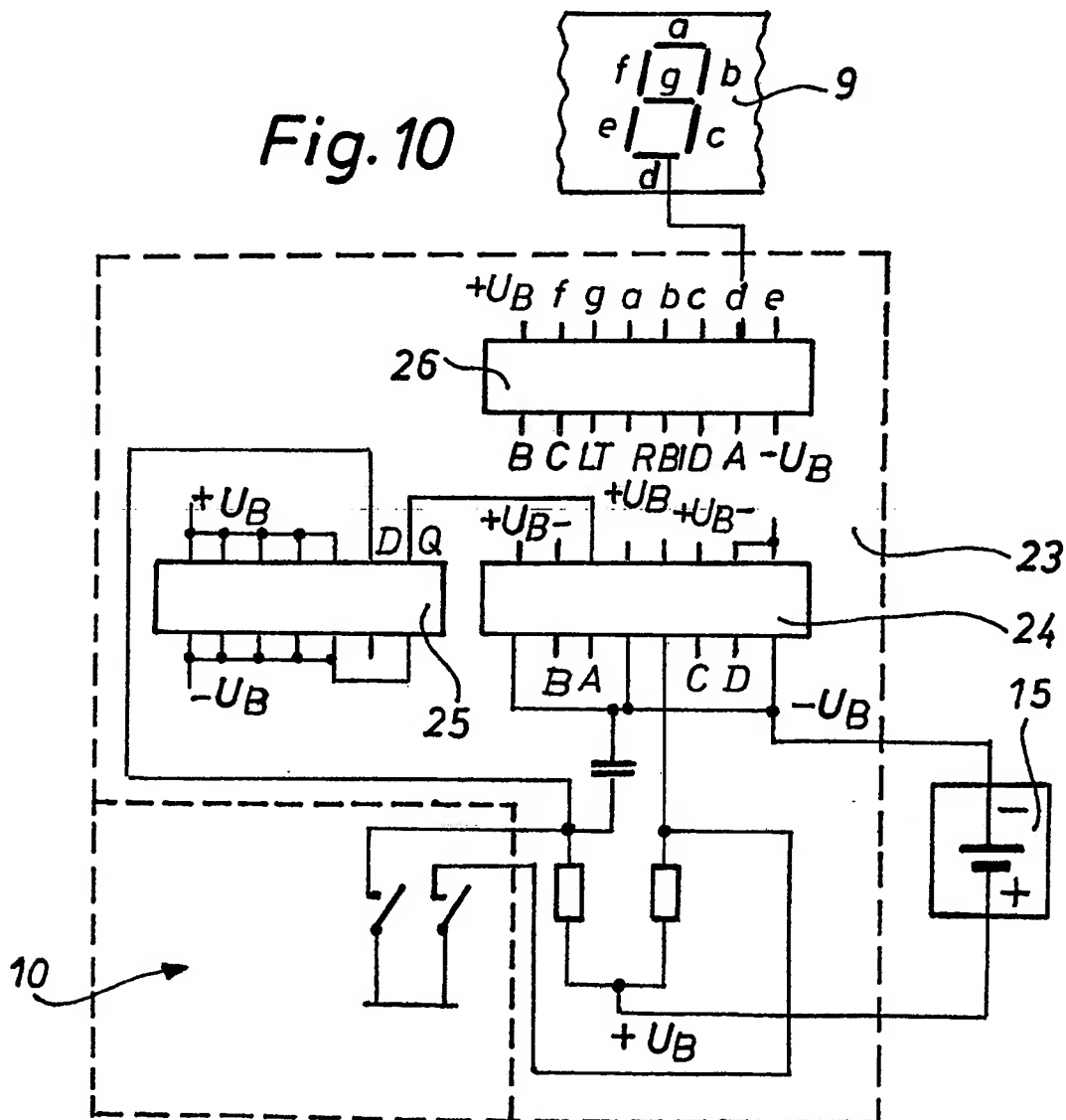




**Fig. 7**



**Fig. 10**



## SPECIFICATION

## Improvements in or relating to switches

The invention relates to a switch for an electrical unit incorporating a display, for instance of the type in which a counting device receives the switching state produced by manual actuation of a freely accessible rotary button and, in accordance with the position of the counter, forms the display in a display field which may be easily read, is stationary and is constructed so as to operate electronically, the display field and the rotary button being disposed close to one another and a switch contact, which is operated by a control shaft bearing the rotary button, cooperating with the counting device.

In one possible switch of this type the display field is arranged above the rotary button in a housing wall and the rotary button comprises towards the front, in an integral manner, a non-transparent front wall. This arrangement not only requires a large amount of space but also does not enable the display and the rotary button to be viewed simultaneously and comfortably during rotation.

A switch of an electrical unit known in practice, has a three-fingered mechanical numerical display, one window being provided per figure, behind which window the periphery of a wheel runs, the periphery being provided with figures from zero to nine and it being possible to push the wheel forwards or backwards by pressing one push-button above the window and one below. The mechanical display field is formed by the three windows in the housing of the switch and two relatively small pushbuttons per figure are provided. Although the area required by the display field and the pushbuttons is not excessively great the three-figure display is easily read. However, the manual operation of the pushbuttons is convenient since different push-buttons have to be operated when the switch is adjusted and these buttons are very small.

A switch of an electrical unit with a display is also known from practice, in the case of which a rotary button which has to be rotated by hand is provided as the actuating member, which button is frame by a display ring which is secured to the housing and on which two-digit numbers are shown close to one another. On account of the closeness this display is not easily read and is even more difficult to read when three-digit numbers are used or a fairly large number of various two- or three-digit numbers are to be available for display. Although, in the case of this switch, manual operation of the rotary button is simple and uncomplicated, it is not easy to read when a certain area is required by the rotary button and the display ring is to be maintained and a greater variety of multidigit displays is desired.

According to the invention, there is provided a switch for an electrical unit, comprising a counting device arranged to receive the switching state produced by manual operation of a freely accessible rotary button and, according to the

position of the counter, to form a display on an easily readable stationary display field which operates electronically, the display field and the rotary button being disposed adjacent one another and a switch contact, arranged to be actuated by a control shaft bearing the rotary button, cooperating with the counting device, the electronic display field being mounted in the rotary button at a front end face thereof, the display field being supported by a connection member which projects into the rotary button towards the rear thereof in the axial direction, and the front end face of the rotary button being transparent substantially all around.

Such a switch can provide a rotary button which continues to be freely accessible or may be gripping the rotary button and display to be observed simultaneously.

In such a switch, the manual operation of the rotary button is easy and the area required by the display field and the rotary button is reduced by installing the display field in the rotary button. As a result of the use of an electronic display field and a counting device which is to be actuated by the rotary button, a rotary button is associated, in a simple and uncomplicated manner, with the easily readable display field for a multi-figure display which is to be formed in various ways.

By easily turning the rotary button a greatly increased number of various multi-figure displays may be reproduced on a reduced area in an easily readable manner. In this case the display field is viewed in the direction of the control shaft.

The display field may be disposed in the rotary button and not in front of the front end face of the rotary button by means of a bridge which overlaps the rotary button. The display field is not provided in the surface area of the rotary button so that, in spite of the ease of reading, the ease with which the rotary button may be gripped is ensured. In addition, the display field arranged in the hollow switching button may be secured to a housing wall by means of the connection member for example and is visible on account of the suitable structure of the front side of the rotary button.

A preferred switch may comprise as fixed parts a housing, the electrical unit, which for example is the electrical unit of a coding switch, and the display field, disposed in the rotary button, with a connection which, on the one hand, serves the mechanical securing of the display field and, on the other, connects the display field electrically with the counting device which is to be associated with the electrical unit. There may be provided as movable parts the rotary button at the control shaft and the movable part of the switch contact which is provided for the actuation of the electrical unit and the counting device. In each case the rotary button comprises a gripping ring which is secured, via a radial bracing, to the control shaft, which, in the usual manner, projects out of the switch housing and the rotary button is disposed outside the housing.

Preferably, the radial bracing, which connects the gripping ring of the rotary button to the control

shaft, is non transparent over a maximum of 20° when viewed in the peripheral direction, and is disposed at the free end of the control shaft in front of the display field. This is one possibility in order to ensure, despite the outwardly leading mechanical and also, if necessary, electrical connection of the display field, the free rotating ability of the display button through more than 360°. The radial bracing is, for example, a thin steel spoke which is only able to cover the display field to a negligible extent, or it may also be a transparent disc.

Preferably, the radial bracing, which connects the gripping ring of the rotary button to the control shaft, is an inherently rigid, thin disc, which is disposed behind the display field and may be pivoted through 360° at most in one direction. In this case no radial bracing is provided in front of the display field. The rotary button, however, cannot be rotated any extent desired in one direction but the ability to rotate is limited by the stop of the radial bracing at the connection.

Preferably the radial bracing, which connects the gripping ring of the rotary button in the control shaft, is formed by a toothed rim provided at the switch button, a toothed rim provided at the control shaft and a pinion disposed with a fixed axis of rotation and engaging in the two toothed rims. This radial bracing is similar to a planetary gearing and ensures free rotating ability of the rotary button even when the bracing is disposed behind the display field. In the case of this radial bracing all rotating spoke formations are avoided and the rotary button can be rotatably supported on a stationary bearing.

It is possible to construct the display field and the rotary button completely independently in each case. It is however, particularly advantageous if structural elements of the rotary button are combined with structural elements of the electronic display field. As a result thereof the structure of the unit comprising rotary button and display field is simplified. Common or combined structural elements may, for example, be the front parts of the rotary button which act as window framing of the electronic display field. A fixed pivot bearing of the rotary button may also be used as the support for the display field.

In one embodiment of the invention which is suitable in certain circumstances, the single rotary button is only provided with one single digit for the display which then can be formed so as to be relatively large, and a plurality of rotary buttons are provided close together in a row, in order to form the multi-digit display. It is therefore particularly suitable and advantageous if a plurality of rotary buttons is arranged close together in a row and each rotary button is equipped with one or two digits of the electronic display field.

It is also advantageous if the display field provided on the rotary button comprises at least two, preferably three or more, figures. In this way a plurality of display figures which can in each case be easily read is provided on one relatively

large rotary button.

Switches which are to be actuated by rotary buttons and having an electrical unit are known *per se* and therefore need not be discussed in further detail. Switches of this type are in principle used for a variety of appliances. However, in the case of switches for use in coding switches, the problem of displaying a wide range of varying multi-figure displays on a small area such that they are clearly visible is particularly great.

It is possible to install an electronically constructed switch device together with a switch contact in the switch housing of conventional rotary-button switches. It is, however, particularly advantageous if the counting device, the switch contact and, if necessary, a battery and a change-over electrical system are combined with the rotary button and the electronic display field to form one unit. In this embodiment the switch may be constructed in any manner desired, for example in the conventional manner and a rotary button with a display field etc. may easily be placed on the control shaft projecting out of the switch housing.

The display field may be constructed in a manner known *per se* and may comprise, for example, known luminous figures such as LED, LCD, etc. The display field is, for example, rectangular for single or multi-figures or it is circular. In other embodiments it is provided with openings for the passage of the control shaft or with connection contacts disposed in a circular manner.

Connections for an external supply voltage, i.e. which is disposed outside the rotary button, may be formed, for example, as pressure, socket, screw or soldered contacts. In this case it is advantageous if the connection member is not only constructed so as to be suitable for the mechanical securing of the electronic display field but also for the electrical connection.

Contacts of this type also take over the mechanical fastening of the stationary part of the display rotary button at the switch body, switch housing or a face plate of the appliance and are constructed for example as bayonet locks with points of contact.

It is possible to adjust an electrical analog value by rotating the control shaft by means of the switch contact, which value may be converted to a corresponding digital value which is supplied to a coding switch, which connects individual segments of the display field, in order to display the figure corresponding to the respective digital value. In other preferred embodiments a coding switch for the display is directly actuated by rotating the control shaft.

It is particularly advantageous in this connection if the switch contact is constructed as a rotary switch coding device with contact fingers, the movable part of which is connected to the control shaft and the stationary part of which bears the contact leads to the display field. If a coding device of this type is disposed in the rotary button the actuation element of the coding device may be constructed for example in the form of a

lever, ring, cap or disc, i.e. secured to the rotary button or integral therewith.

A cording device with a plurality of electric circuits per figure or digit may thus be replaced by a unit comprising a coding device with fewer electrical circuits or a single electrical circuit plus its change-over electrical system. Depending on the design, the internal battery and the change-over electrical system are associated with the fixed part or the movable part of the display-rotary button.

The change-over electrical system may thus, for example, be housed therewith either on the movable part or on the fixed part of the switch-coding device; in the latter case it either forms a separate assembly or a joint assembly with the display field.

If the counting device is to be constructed so as to be particularly small, it is formed electronically. However, it is also possible to use a mechanical counting device which comprises, for example, seven rotary switches. In this case each rotary switch has a switch contact which converts the rotation of the rotary button into an electrical signal. It is possible to construct the electrical device, i.e. the unit comprising the counting device, the switch contact and the display field, such that counting may be carried out not only when rotation is performed in an upward direction, i.e. from small to large numbers, but also when rotation is carried out in the opposite direction downwards, i.e. from larger to smaller numbers.

This electrical unit or this counting device may also contain a memory from which previously determined combinations of figures are recalled in order to be made visible on the display field.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a lateral view with parts cut away according to line I—I in Figure 2 of a switch with multi-figure display;

Figure 2 is a front view of the switch according to Fig. 1;

Figure 3 is a lateral view with parts cut away according to line III—III in Figure 4 of a switch with a multi-figure display;

Figure 4 is a front view of the switch according to Fig. 3;

Figure 5 is a section of a switch with a two-figure display;

Figure 6 is a front view of the switch according to Fig. 5;

Figure 7 is a section of a further switch with a multi-figure display;

Figure 8 shows schematically a front view of a switch with a multi-figure display;

Figure 9 shows schematically a front view of switches having a multi-figure display; and

Figure 10 is an electrical circuit diagram of a switch having a multi-figure display.

The switches according to Figures 1 to 4 have in each case a switch base 1, which may be constructed if necessary as a coding switch, comprises a switch housing 2 in which an

electrical switching device, not shown in greater detail, is housed, which switching device may be connected, via connections, which are not shown and project out of the housing 2, to an electrical unit which is to be regulated or switched on by means of a switch. Out of the switch housing 2 projects in each case a threaded socket 3, in which a control shaft 4 is rotatable, which shaft 4 is directed into the switch housing, in order to operate the switching device therein, and projects out of the switch and the threaded socket.

The control shaft 4 bears in each case a rotary button 5, which is cup-shaped, has its open side facing the switch base 1, encircles the control shaft with a gripping ring 6 and comprises a front part 7 opposite the open side. In each case a fixed connection member 8 is provided which projects towards the rear of the rotary button 5 and towards the front bears an electronic display field 9. An electronic counting device 10 is constructed as a rotary switch coding device, acts as a switch contact and comprises a movable part 11 which is rigidly connected to the control shaft 4 and bears trip cams 12 in the form of contact fingers.

These act on the fixed part 13 of the counting device 10 which is electrically connected to the display field 9, in a manner which is not shown in greater detail, and is carried by the connection member 8. The rectangular display field 9 is in each case provided at the front end face of the rotary button 5.

In the embodiment according to Figures 1 and 2 the connection member 8 is formed like a sleeve and is disposed in the rotary button 5. It is fastened directly to the switch housing 2 by means of a nut 14 screwed onto the threaded socket 3. The sleeve-shaped connection member 8 holds the counting device 10. The movable part 11 is formed like a disc and is rigidly mounted on the control shaft 4 which also projects through the fixed part 13 which is formed like a disc, and the end of which shaft 4 is centrally screwed to the front part 7. The fixed part 13 is fastened at the periphery to the connection member 8 which, towards the front, bears the display field 9 and a battery 15. The front part 7 is transparent so that the display field 9 is visible in any position of the rotary button. The display field 9 has three digits and is completely disposed on one side of a median plane lying through the control shaft.

In the embodiment according to Figures 3 and 4 the switch is secured to a wall 16 of an apparatus by means of a nut 14 screwed onto the threaded socket 3. The connection member 8 is a bar which is inserted into the wall 16 of the apparatus and projects away therefrom and is disposed in the rotary button 5. The movable part 11 of the counting device is formed as a disc and is secured to the gripping ring 6 via an attachment. The stationary part 13, formed as a disc, is secured to the bar-like connection member 8 via an attachment. The stationary part 13 bears towards the front the centrally disposed display field 9 which, like the counting device 10, is contained in the rotary button 5. For the voltage

supply a connection line 17 is guided through the base of the connection member, that is, through the wall 16 of the apparatus. The display field 9 has three digits but it may also be longer and in that case it is constructed so as to have four digits. The front part 7 is transparent such that the display field is visible in any position of the rotary button.

In the switch according to Figures 5 and 6 a gripping ring 6 of a rotary button 5 is also provided with a transparent front part 7 which is secured to the control shaft 4. A display field 9 disposed in the rotary button 5 is carried by a connection member 8, disposed above the control shaft 4 and displays letters instead of figures. The display field 9 is connected, via a connection line 17, to the counting device 10 which is disposed outside the rotary button in the housing 2 of the switch base which comprises further electrical switching devices.

In the embodiment according to Figure 7 a stationary, circular sliding bearing 18 is provided which is fastened to the wall 16 of the apparatus and is also rigidly connected to the connection member 8. The gripping ring 6 with a support groove 19 is rotatably mounted on this bearing 18. The display field 9 and the switch device 10 are combined in a compact manner. The rotary button 5 is rotated by the control shaft 4 since the latter bears a toothed rim 20 with external teeth, which rim 20 meshes with a pinion 21 which is rotatably supported by the connection member 8. The pinion 21 meshes with the inwardly directed teeth of a toothed rim 22 which is secured to the inner side of the gripping ring 6 of the rotary button 5. The one pinion 21 may also be replaced by two or more pinions which in each case are mounted so as to be stationary and engage in one another. The connection member 8 also supports at the lower part of the rotary button a battery 15 and a change-over electrical system 23.

According to Figure 8 a plurality of rotary buttons 5, all of equal size, are disposed in a row close to each other and jointly form a display field 9, only one figure of the display field 9 being disposed in the front end area of each rotary button. An annular front part 7 comprises in each case one figure of the display field.

According to Figure 9 equal-sized rotary buttons 5 are likewise provided close to one another in a row. One figure of a display field 9 is, however, disposed in each case along a diameter on both sides of the centre. The rotary button is in each case essentially still only formed by the gripping ring 6 located behind the display field figures, which ring 6 is connected to the control shaft 4 via struts 21, which shaft 4 supports at the free end a disc-like single front part 7.

The electrical circuit diagram according to Figure 10 is shown for one figure of a multi-figure display field. According to Figure 10 a battery 5 is provided for the supply of the entire system. Furthermore there is a counting device 10 which comprises a change-over electrical system 23.

The counting device 10 comprises (on the left) a switch contact, which is used for counting, and (on the right) a switch contact which regulates the counting direction. This (righthand) switch contact is open then the counting process is performed backwards and is closed when the counting process is performed forwards. The change-over electrical system 23 comprises a reversible counter 24, a trigger 25, and a driver/decoder 26. From there the electrical signals are delivered to the display field 9.

## CLAIMS

1. A switch for an electrical unit, comprising a counting device arranged to receive the switching state produced by manual operation of a freely accessible rotary button and, according to the position of the counter, to form a display on an easily readable stationary display field which operates electronically, the display field and the rotary button being disposed adjacent one another and a switch contact, arranged to be actuated by a control shaft bearing the rotary button, cooperating with the counting device, the electronic display field being mounted in the rotary button at a front end face thereof, the display field being supported by a connection member which projects into the rotary button towards the rear thereof, in the axial direction, and the front end face of the rotary button being transparent substantially all around.

2. A switch as claimed in claim 1, in which a radial bracing, which connects the gripping ring of the rotary button to the control shaft, is nontransparent over a maximum of 20° when viewed in the peripheral direction and is provided at a free end of the control shaft in front of the display field.

3. A switch as claimed in claim 1, in which a radial bracing, which connects the gripping ring of the rotary button to the control shaft, is an inherently rigid thin spoke which is disposed behind the display field and is pivotable through a maximum of 360° in one direction.

4. A switch as claimed in claim 1, in which a radial bracing, which connects the gripping ring of the rotary button to the control shaft, is formed from a toothed rim provided on the switch button, a toothed rim provided on the control shaft and a pinion which engages in the two toothed rims and is arranged with a fixed axis of rotation.

5. A switch as claimed in any one of the preceding claims, in which the structural elements of the rotary button are combined with structural elements of the electronic display field.

6. A switch as claimed in any one of the preceding claims, in which a plurality of rotary buttons are arranged close to one another in a row and each rotary button is equipped with only one or more figures of the electronic display field.

7. A switch as claimed in any one of claims 1 to 5, in which the display field comprises at least two, preferably three or more figures.

8. A switch as claimed in any one of the preceding claims, constructed as a coding switch.

9. A switch as claimed in any one of the preceding claims, in which the counting device, the switch contact a battery when present, and a change-over electrical system are combined with the rotary button and the electronic display field to form a unit.
10. A switch as claimed in any one of claims 1 to 8, in which the connection member is constructed so as to be suitable for the mechanical fastening of the fixed display field and for providing electrical connection.
11. A switch as claimed in any one of the preceding claims, in which the switch contact is constructed as a rotary switch coding device with contact fingers, a movable part of which is connected to the control shaft and a stationary part of which carries contact leads to the display field.
12. A switch for an electrical unit, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.